

LABORATORY ANALYSES IN TREATMENT PLANT OPERATIONS

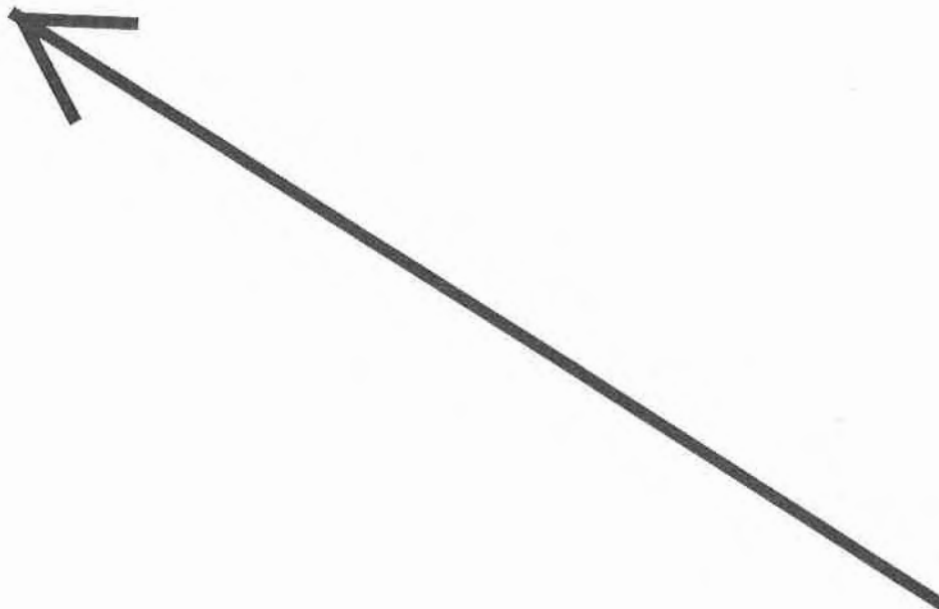
This course is offered for operators and other personnel responsible for laboratory control and management in wastewater treatment.

**ENVIRONMENTAL PROTECTION AGENCY
Water Programs Operations
TRAINING PROGRAM**

December 1972

- 2 Gales, Morris E., Jr., Julian, Elmo C., and Kroner, Robert C., Method for Quantitative Determination of Total Phosphorus in Water. JAWWA 58: (10) 1363. October 1966.
- 3 Lee, G. Fred, Clesceri, Nicholas L. and Fitzgerald, George P., Studies on the Analysis of Phosphates in Algal Cultures. Int. J. Air & Water Poll. 9:715. 1965.
- 4 Barth, E. F. and Salotto, V. V., Procedure for Total Phosphorus in Sewage and Sludge, Unpublished Memo, Cincinnati Water Research Laboratory, FWQA. April 1966
- 5 Moss, H. V., (Chairman, AASGP Committee) Determination of Ortho Phosphate, Hydrolyzable Phosphate and Total Phosphate in Surface Water. JAWWA 56:1563. December 1958.
- 6 Methods for Chemical Analysis of Water & Wastes, EPA-AQCL, 1971.

This outline was prepared by Audrey E. Donahue, Chemist, National Training Center, DTTB, MDS, WPQ, EPA, Cincinnati, OH 45268.





Project Summary

Enzyme Addition to the Anaerobic Digestion of Municipal Wastewater Primary Sludge

Gregory M. Higgins and Joseph T. Swartzbaugh

This study was conducted to evaluate the effects of adding enzymes to a municipal wastewater (MWW) sludge anaerobic digester. The primary objective was to examine the impact of using enzymes to enhance the degradation of the cellulosic and the oil- and grease-rich sludge fractions. This project was conducted under a cooperative agreement to the City of Xenia, Ohio, with subcontracting to Systech Corporation, Xenia, Ohio.

This Project Summary was developed by EPA's Water Engineering Research Laboratory, Cincinnati, OH, to announce the major results of a project that is documented in a separate report of the same title (see Project Report ordering information on the back page).

Introduction

One of the most commonly employed treatment methods for municipal wastewater (MWW) solids is anaerobic digestion followed by one of a number of ultimate disposal options. This process is particularly advantageous in that it produces a sludge suitable for land application, efficiently reduces pathogenic organisms, produces a potentially useful by-product fuel gas, and is generally accompanied by low operating costs. Despite these advantages, currently used anaerobic digestion technology has several operational and technical limitations. One of the most significant of these is the level of volume reduction achieved. Although anaerobic digestion reduces sludge volume and mass, the constantly growing cost and number of federal and state regulations governing the disposal of MWW sludges

requires that current technology be optimized to produce the smallest amounts of sludge possible.

The objective of this program was to evaluate the application of enzyme augmentation to current MWW anaerobic digestion practices. This concept was viewed as a method to enhance the sludge volume reduction and fuel gas production. Although commercial enzyme augmentation products are available for use in MWW treatment systems, an extensive search of the relevant experimental literature conducted during this project indicated very few useful data regarding their use.

Cellulase Enzyme Addition

The application of cellulase enzymes to enhance the anaerobic digestion of cellulosic component of MWW sludge was evaluated in a series of laboratory-scale studies. Three modes of applying the enzymes were examined — as a pretreatment, post-treatment, and simultaneous treatment option with respect to anaerobic digestion. The pretreatment option incorporated a two-phase digestion process and was by far the most technically successful of the options examined. However, the advantages of this option were largely due to the two-phase process used to accommodate the pH requirements of the enzyme rather than to the enzyme additions. Compared with a single-phase digestion system, increases of 45 and 44 percent were observed for total solids reduction and methane production as a result of the two-phase digestion process alone. Addition of enzyme to the two-

phase system further increased solids reduction and methane production to 60 and 66 percent.

Experimental data scaled to the size of the Xenia facility were compared with typical operations at a 15-day hydraulic-retention-time, single-phase digester system modeled on the Xenia facility. Results indicated that a net yearly savings of \$11,133, equivalent to a 7-mo payback period for additional equipment, could be achieved by using the two-phase digestion process without enzyme addition. To accomplish this result, the facility would need a minimal increase in tankage capacity. Based on the current cost of commercially available enzyme, an additional yearly savings of \$1,525 would result from adding enzyme to the two-phase system. This savings could increase if enzyme costs could be reduced.

Lipase Enzyme Addition

The use of lipase enzymes to increase the rate of decomposition of the oil and grease component of MWW sludge solids was evaluated in a similar series of laboratory experiments conducted with direct enzyme addition to a single-phase anaerobic digestion system operated at a 15-day hydraulic retention time. Compared with control conditions, increases of 1 and 4 percent were observed for total solids reduction and methane production as a result of lipase enzyme addition. Based on current enzyme costs, a net yearly savings of \$701 would result from the use of lipase enzymes. No additional tankage capacity would be required for this process. Further increases could potentially be achieved by operating the system at a longer retention time.

Conclusions

The overall results of the project show little advantage for enzyme addition to anaerobic digestion. The major improvements seen were due to the staging of the digestion process, which was done in order to accommodate the pH requirements of the cellulase enzyme. The conclusions are, therefore, as follows:

- (1) Two-phase digestion used to accommodate cellulase addition in this study shows promise for increasing the efficiency for anaerobic digestion.

- (2) The addition of cellulase enzyme shows a moderate improvement in the two-phase digestion process without enzyme addition.

- (3) The addition of lipase enzyme under the condition studied shows only minimal improvement in anaerobic digestion.

The full report was submitted in fulfillment of Cooperative Agreement No. 810279 by the City of Xenia, Ohio, under the sponsorship of the U.S. Environmental Protection Agency.

Gregory M. Higgins and Joseph T. Swartzbaugh are with SYSTECH Corporation, Xenia, OH 45385-9354 (J. T. Swartzbaugh is presently with PEER Consultants, Inc., Dayton, OH).

B. Vincent Salotto was the EPA Project Officer (see below for present contact). The complete report, entitled "Enzyme Addition to the Anaerobic Digestion of Municipal Wastewater Primary Sludge," (Order No. PB 87-101 788/AS; Cost: \$16.95, subject to change) will be available only from:

*National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650*

*For further information, Harry E. Bostian, can be contacted at:
Water Engineering Research Laboratory
U.S. Environmental Protection Agency
Cincinnati, OH 45268*

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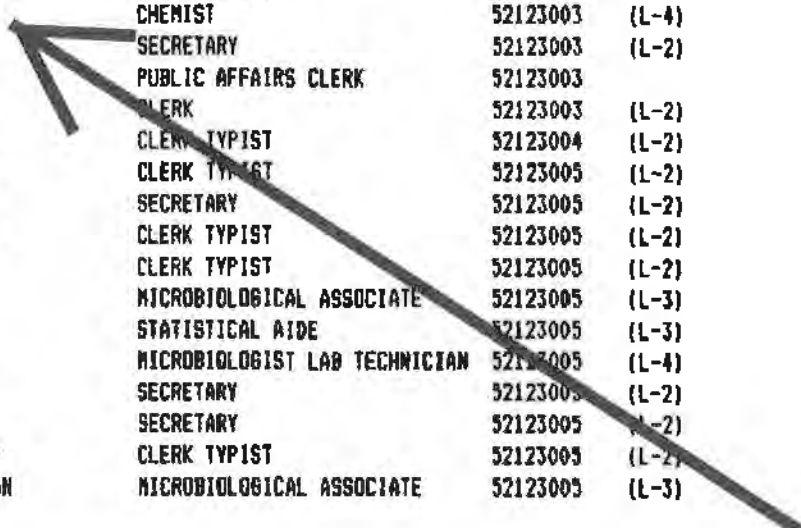
For: Cooperative Agreement #CQ-814361
6303
Environmental Research Cincinnati
08/01/87 - 07/31/90

To: Ms. Patricia Powers, Director
Workforce Development
U.S. Environmental Protection Agency
Washington, D.C. 20460

From: Mr. Larry E. Anderson, Director
AARP/SEE Program Department
Washington, D.C. 20049

CURRENT JOB DESCRIPTIONS
AND JOB LEVELS
AS OF 4-19-90

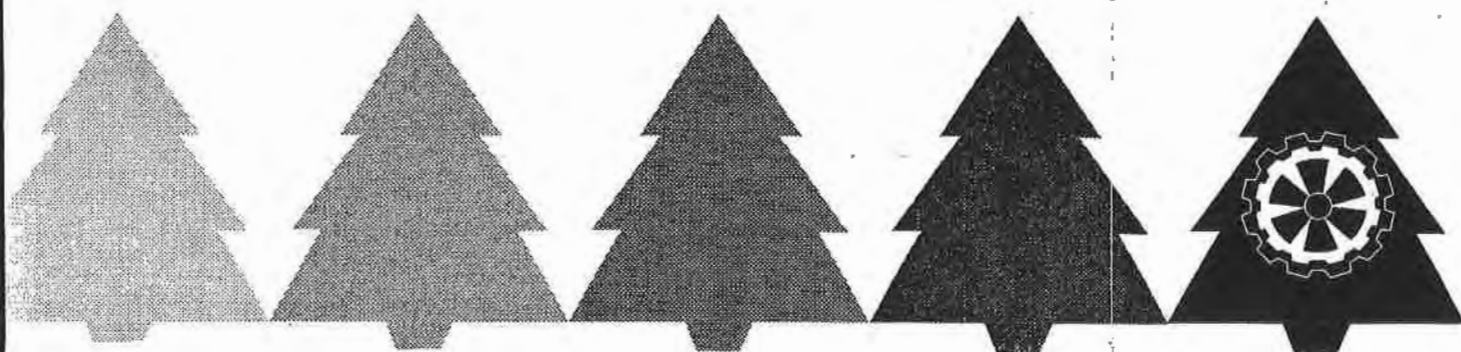
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Office of Environmental Engineering and Technology Demonstration

Annual Report
Innovative Technologies Progress
FY 1991 - FY 1992



AWARDS

Bronze Medals

- For outstanding pioneering effort to develop universally accepted, extremely useful measures of water quality, namely, total organic halide. Ronald C. Dressman—RREL
- For distinguished service in promoting the development and commercialization of innovative environmental technologies through the President's National Technology Initiative. Annette Gatchett—RREL
- For remarkable achievement in the Byers Warehouse T/Silvex removal action. Donald Oberacker and Joyce Perdek—RREL
- For exemplary performance in completing an Agency goal of establishing New Source Performance Standards and emission guidelines to control toxic air emissions from municipal waste combustors. Theodore G. Brna and James D. Kilgroe—AEERL
- For exhibiting a high degree of initiative and original thought in successfully issuing the Section 507 Small Business Assistance Guidelines. Charles H. Darwin—AEERL
- The Interaction of Vapor Phase Organic Compounds with Indoor Sinks. Bruce A. Tichenor and Leslie Sparks—AEERL
- Minimization of Transient Emissions from Rotary Kiln Incinerators. Paul Lemieux and William Linak—AEERL

Honorable Mention-STAA Awards

- Reduction in Bacterial Densities of Wastewater Solids by Three Secondary Treatment Processes. Joseph B. Farrell, B. Vincent Salotto, Albert D. Venosa—RREL
- Characterizing Surface Waters that May not Require Filtration. Edwin E. Geldreich, James A. Goodrich, Robert M. Clark—RREL
- Concerns with Using Chlorine Dioxide Disinfection in the USA. Benjamin W. Lykins, Jr., James A. Goodrich, John C. Hoff—RREL

EPA Science Achievement Award (Engineering)

- For significant research into understanding the mechanisms of formation and prevention of chlorinated dioxins and furans in waste combustion systems. Brian K. Gullett—AEERL

Administrator's Award for Excellence

- Patricia E. Sharpe—AEERL

Special Award

- ORD's BCD Process Wins *R&D Magazine's* R&D 100 Award. Each year *R&D Magazine* selects the 100 most technologically significant products of that year and awards to the developers the prestigious "R&D 100 Award." One winning product was ORD's "Base-Catalyzed Decomposition (BCD) Process," a novel method for dechlorinating hazardous chlorinated wastes. The three researchers who developed this process were honored in September 1992 in Chicago's Museum of Science and Industry. Charles Rogers, Albert Kornel, Harold Sparks—RREL

Scientific and Technological Achievement Awards (STAA)

- Modeling Inactivation in *Giardia lamblia*. Robert M. Clark—RREL
- Mouse—A Computerized Uncertainty Analysis System. Albert J. Klee—RREL
- Evaluating the Costs of Packed-Tower Aeration and GAC for Controlling Selected Organics. Jeffrey Q. Adams, Robert M. Clark—RREL
- Evaluation of BAT for VOCs in Drinking Water. Jeffrey Q. Adams, Robert M. Clark—RREL
- Recovery of 3-Chloro-4(dichloromethyl)-5-hydroxy-2(5H)-furanone from Water Samples on XAD Resins and the Effect of Chlorine on Its Mutagenicity. Kathleen M. Schenck, John R. Meier, H. Paul Ringhand, and Frederick C. Kopfler—RREL



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

April 30, 1992

OFFICE OF
THE ADMINISTRATOR
SCIENCE ADVISORY BOARD

EPA-SAB-RSAC-92-019

Honorable William K. Reilly
Administrator
U.S. Environmental Protection Agency
401 M. Street, S.W.
Washington, D.C. 20460

RE: SAB Award Recommendations for the 1991 Scientific and Technological
Achievement Awards Program

Dear Mr. Reilly:

The Science Advisory Board's 1991 Scientific and Technological Achievement Awards (STAA) Subcommittee has completed its review of the 114 papers nominated by the Agency for this year's awards program. As you are aware, the STAA program is sponsored by the Office of Research and Development, which has made substantial improvements in the collection and distribution of these nominations. Our recommendations for awards and further improvements in the STAA program are discussed in the attached report.

The Subcommittee believes the STAA program contributes very positively towards strengthening the level of Agency scientific and technical expertise by recognizing researchers for their special achievements and the good science their research reflects. Therefore, we urge that the program receive support from the highest levels of Agency management and that the winners receive broad recognition both inside and outside the Agency. EPA should initiate press releases and EPA Journal feature articles profiling the achievements of the award recipients.

We are pleased to have participated in this process and believe it is appropriate for the Board to continue this annual review function. The Subcommittee also recommends the Agency establish a minimum cash award of five hundred dollars (\$500.00) for all eligible award recipients, regardless of the level of the award or the number of EPA authors. Further, the Subcommittee recommends that EPA establish a separate award for sustained and outstanding scientific publications by its senior scientists and that EPA add a category to the STAA for technical accomplishments in the field of risk management and policy formulation.



United States
Environmental
Protection Agency

Science Advisory
Board (A-101)

EPA-SAB-RSAC-92-019
April 1992

AN SAB REPORT: RECOMMENDATIONS ON THE 1991 EPA STAA NOMINATIONS

**PREPARED BY THE SCIENTIFIC AND
TECHNOLOGICAL ACHIEVEMENT
AWARDS SUBCOMMITTEE OF THE
RESEARCH STRATEGIES ADVISORY
COMMITTEE**

T9116

"Identification of Volatile Hydrocarbons as Mobile Source Tracers for Fine-Particulate Organics"

Journal:

Environmental Science and Technology

Volume 24, Number 4, Pages 538-542, April 1990.

Submitting Office/Laboratory:

Atmospheric Research & Exposure Assessment Laboratory

EPA Author(s):

Roy B. Zweidinger

Robert K. Stevens

Charles W. Lewis

Non-EPA Author(s):

Hal Westburg

3.2 Honorable Mention

The Subcommittee identified thirteen papers which did not reach award level but which deserve honorable mention for their quality and quantity of work. In several cases, these papers should form the foundation for significant future accomplishments that may merit awards. The Subcommittee hopes that these authors will be recognized appropriately for their high quality of work.

Honorable Mention

C9104

"Reduction in Bacterial Densities of Wastewater Solids by Three Secondary Treatment Processes"

Journal:

Research Journal of the Water Pollution Control Federation

Volume 62, Number 2, Pages 178-184, March/April 1990.

Submitting Office/Laboratory:

Risk Reduction Engineering Laboratory

EPA Author(s):

Joseph B. Farrell

B. Vincent Salotto

Albert D. Venosa

